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The following communications were read:—

I. Occultations observed at Port Royal Dockyard, Jamaica. By Capt. Alexander Milne, H. M. S. Crocodile. Communicated by the Rev. Geo. Fisher.

Date.	Phenomenon.	Star.	Mean S. Time.	Longitude Computed from the Elements as given in the N. Almanac.
1839.			h m s	° ′ ″
Nov. 17	Im.	δ Piscium	6 50 37·0	76 48 52 West.
19	...	μ Arietis	6 28 54·7	76 47 7
20	...	*b* Pleiadum	5 51 53·3	76 50 30
20	...	*e*	6 6 20·3	76 49 12
20	...	*c*	6 13 3·3	76 48 35
20	Em.	?	12 6 30·0	

The two first observations are excellent ones. The results from the others may be vitiated in a very slight degree by the moon being a little past the full at the time of observation; but the times I believe to be faultless. The latitude of the place of observation (which was the Commodore's House) was determined by a mean of several observations, made with great care, to be 17° 56′ 35″ North.

II. Observations of the Beginning and End of the Solar Eclipse on the 8th July, 1842. In the Fort on the left bank of the Shanghaie River, near to the Town of Woosung, on the Coast of China. By Capt. Sir Everard Home, Bart. F.R.S., H. M. Ship North Star. Communicated by the Rev. Geo. Fisher.

Latitude of the Place of Observation, 31° 26′ 36″ North.

	h m s	
Beginning of Eclipse, M. S. Time	3 16 54·7	nearly.
End ditto	5 24 1·0	Very good observation.

The error of the chronometer, determined by several sets of observations of the upper and lower limbs of the sun with an 8-inch sextant and false horizon by Troughton; telescope by Tulley, 4 feet; aperture, 3½ inches; power, 90.

III. Translation of a Letter from M. Hansen to R. W. Rothman, Esq., accompanying a copy of a printed paper on the Perturbations of the Heavenly Bodies moving in very Eccentric and very Inclined Orbits.

"Sir,—I have the honour to send you herewith the abstract of a memoir in which I have developed a method for calculating the perturbations of those celestial bodies which move in very eccentric and very inclined orbits. I beg you to forward this abstract to the Royal Astronomical Society. In this memoir I have treated only the case in which r is less than r', and I have simply adverted to the case in which r is greater than r'. That I may be better understood, I add here that, in this case, it is the true anomaly of the perturbed body which must be employed. The integration is performed in this case in an analogous manner; but we cannot make the factors of integration depend on continued fractions: those factors depend in this case on a linear differential equation of the first order.

"Accept the expression of high consideration with which I am, Sir, your very obedient servant,

"P. A. Hansen.

"*Gotha, March* 1, 1843."

IV. On the Application of the Method of Least Squares to the Determination of the most probable Errors of Observation in a portion of the Ordnance Survey of England. By Thomas Galloway, Esq. A.M. F.R.S., one of the Secretaries of the Society.

The object of this communication is to give the results of an application to a part of the Ordnance Survey, of a general method of correcting the observed horizontal angles, whereby the positions of the stations are determined in such a manner as to give the nearest, or most probably accurate, representation of the whole of the observations. The method in question, which is due to Gauss and Bessel, has only recently been introduced into geodesy. In all the geodetical measurements which were executed prior to the latter part of the last century, the errors of observation were of such magnitude that it was unnecessary to take account of the curvature of the earth, and the triangles were accordingly computed as if they had been on a plane surface. On this hypothesis the sum of the three angles of each triangle is 180°; and as the strict fulfilment of this condition is necessary for the computation of the triangles, the universal practice was to apply arbitrary corrections to the observed angles, the observer usually assigning the largest correction to the angle which he *supposed* most likely to be erroneous. The large and excellent theodolite used by General Roy in his triangulation (begun in 1784) for connecting the observatory of Greenwich with the meridian of Paris, and the repeating circle of Borda, introduced about the same time on the Continent, gave the means of measuring terrestrial angles with far greater precision than had been obtained with the old quadrants,

and the curvature of the earth became a necessary element in ascertaining the amount of the errors of observation. No alteration was, however, required on this account in the mode of correcting the angles, for as the *spherical excess* can be computed from approximate values of the sides to any required degree of exactness, the condition necessary for the computation of an individual triangle was still that the sum of the three horizontal angles should be equal to a known quantity; and in all the principal trigonometrical operations of which accounts have been published (excepting Colonel Everest's prolongation of the Indian arc of meridian, and some recent surveys in Germany), this condition (speaking generally) is the only one which has been attempted to be satisfied in computing the observations. But the observance of this single condition is not by any means sufficient to give the best representation of the *whole* of the observations; nor does it even suffice to give a determinate solution of the problem under consideration, for when the distance between two stations is computed through different series of triangles, each mode of computing leads to a different result. When the instrument has been set up at every station, and the angles between the other stations visible from that point have been all observed, other geometrical relations are established which the corrected angles ought likewise to satisfy, and angles are obtained which cannot be made use of otherwise than in satisfying such relations. Now, it is manifest that any mode of computing the triangles in which any observed angle is not taken account of, or any geometrical relation among the parts of the figure not satisfied, or which does not allow to every single observation its due influence, cannot be regarded as satisfactory. In order to obtain the nearest representation of the whole of the observations, or the result which is affected by the smallest probable error, it is necessary to solve the following problem, *viz.* to determine the corrections which must be applied to the observed angles in order that they may satisfy *all* the geometrical relations or equations of condition, and in order that the sum of the squares of the corrections may be an absolute minimum. A general solution of this problem was given by Gauss in his *Supplementum Theoriæ Combinationis*, &c. (Gottingen, 1828), and the method has been applied by Bessel to the triangulation for the measure of the meridional degree in Prussia, and also to the computation of the extension of the French meridian through Spain, from Montjouy to Formentera.

The triangulation which has been selected in the present case for an example of the method, includes ten stations (commencing with the base on Hounslow Heath), at which thirty-five independent angles were observed. For determining the corrections of those angles, nineteen equations of condition are furnished by the observations, among which are instances of all the kinds which can occur in a trigonometrical survey. The final results differ extremely little from those given in the *Survey*, the greatest difference in the length of any side amounting only to about half a

foot, and this in a distance of nearly eighteen miles. This close agreement must be attributed, however, to the smallness of the triangles, and the very great accuracy of the observations in this portion of the Ordnance Survey. If the distances between the stations had been two or three times greater, the observations would probably have been less exact, and the differences between the results of the two methods of computation more considerable; but however this may be, it is only by following the method here explained that the whole of the precision which is attained by the observations is preserved in the results; and for this reason the method should be adopted in all important surveys, particularly in those for determining the curvature of the earth. Besides giving a determinate result, and that result the one which is most probably nearest the truth, it has the great advantage of superseding all arbitrary corrections, and admitting only such as are rigorously deduced from the observations.

The methods of deducing the most probable values of the angles from the observations, of assigning the weights, of forming the equations of condition, and all the steps of the process to the final determination of the corrections by which the equations are satisfied, are given at length.

V. The President announced a communication that he had received from the Rev. Baden Powell, relative to an easy and convenient method of imitating the appearance of the *corona*, or glory, that surrounds the body of the moon, during the time of total darkness, in total eclipses of the sun; and also the appearance of the *beads* that occur not only in total eclipses, just prior to the time of total darkness, but likewise in annular solar eclipses. A sketch of the method was exhibited, which is merely this: a candle is placed in the focus of a lens, fixed in a screen, with an aperture of about $\frac{3}{4}$ of an inch in diameter, on the opposite side of which screen is placed an opake circular disc, of equal (or even greater) diameter than the aperture, which may be placed at different distances, so as to produce an eclipse of any magnitude, as the spectator shifts his position. When it is central and total, there is a brilliant ring, or glory, even when it is so much nearer to the eye as to subtend a much greater angle than the aperture. Also, when there are any cusps, minute irregularities, on the edge of the disc, produce distinct *beads*. Professor Powell has tried a similar experiment with the circular opake disc and the rays of the *sun* reflected from a small piece of glass, which produced a most brilliant ring, the disc being nearly double the apparent diameter of the sun: and he proposes to pursue the inquiry still farther.

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